# MONTHLY WEATHER REVIEW,

## APRIL, 1876.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

## INTRODUCTION.

In compiling the present Review, the following data have been made use of, viz: The tri-daily charts, constructed from the simultaneous observations taken at one hundred and forty Signal Service stations, and fourteen Canadian stations, and telegraphed to this office immediately afterward; monthly meteorological records of observations, taken at four hundred and thirty-seven stations, including those from the civilian Voluntary Observers, U. S. Naval Hospitals, U. S. Army Posts, Canadian stations and Signal Service stations; reliable newspaper extracts; special reports from various sections of the country; and Marine Records.

The general features of the month were: (1.) The slight deficiency of temperature throughout the Atlantic States, the Lower Lakes and Canadian Provinces. (2.) The rarity of destructive storms, tornadoes, &c. (3.) The rarity of auroras. (4.) The large excess of rain-fall in the South Atlantic and Gulf States. (5.) The long-continued high water in the Mississippi between Cairo and Vicksburg, ending in the formation on the 26 h of the cut-off at the latter place. (6.) The rarity of destructive frosts. (7.) The heavy snow-storm of the 4th and 5th in New England.

## BAROMETRIC PRESSURE.

The general distribution of atmospheric pressure for April is shown by the isobars upon Chart No. II, which exhibit characteristic differences as compared with the charts for April, 1874 and 1875. A comparatively low pressure is shown for April, 1876, in the Northwest, but about the same pressure in the South Atlantic and Eastern Gulf States, the Pacific coast and Nova Scotia, as compared with the two preceding years.

*Barometric Range.*—The barometric ranges, reduced to sea-level, have been as follows: Large ranges—Alpena 1.45 in., Bismarck 1.20, Buffalo 1.24, Breckenridge 1.23, Detroit 1.15, Escanaba 1.43, Grand Haven 1.15, Marquette 1.58, North Platte, Oswego and Pembina 1.20, Malone 1.26, Port Huron 1.22, Rochester 1.27. Small ranges—Jacksonville 0.52, New Orleans 0.46, Punta Rassa 0.37, San Diego 0.40, San Francisco 0.41.

*Areas of Low Barometer*—In general, the tracks of the paths of the areas of low pressure have lain decidedly to the northward of those of 1874 and 1875. Three have passed eastward over the Atlantic States to the Gulf Stream. Ten have passed east-north-eastward over the Lake region; of these four moved southeastward to the southern boundary of Minnesota, and then turned to the east-north-east. But one of these has been attended by winds attaining the force of a gale on the Atlantic coast.

No. I.—This depression is (as No. VIII of the Review for March) traced back to the Pacific coast. It was on the 1st of April central in Texas, but appears as an insignificant depression until the 4th, when it had increased to a storm off the Middle Atlantic coast, which subsequently moved slowly northeastward over Nova Scotia. Northeasterly winds of from twenty-five to fifty miles were reported on the 4th and 5th on the Middle and East Atlantic coasts, and a heavy snow-fall occurred in New England.

No. II.—This may be considered as a branch of No. I, which was definitely formed on the morning of the 2d in Missouri. It moved thence northward into Minnesota, and then eastward over Lake Superior; light rains but no high winds were reported. Nos. I and II afford an excellent illustration of the fact that as light deficiency of pressure over a large extent of territory, as, for instance, from the Gulf of Mexico to

California or Manitoba, is followed by a general slow southward movement of cool, dry air from British America, on the southern borders of which cloud and rain are formed, and which latter may, under favorable circumstances, give rise to several local barometric depressions, which subsequently increase into well-marked storms. The region to which the beginnings of these storms may be traced extends from the northwestern portion of the Gulf of Mexico up to central Mississippi, central Kansas and western Texas.

No. III.—Is located, first, at midnight of the 3d in western Kansas; it had been preceded for two days by high, cold north and west winds on Pike's Peak and high barometer in Oregon. The area of low barometer rapidly extended northward and southward, but at midnight of the 4th had closed up to an oval area central in Wisconsin. South and west winds of from 20 to 42 miles were reported from the Upper Lakes on the 5th, and from 30 to 35 miles on Lakes Ontario and Huron on the 6th, when the central depression was already beyond the limits of our stations and apparently in the valley of the upper Saguenay river.

No. IV.—This low barometer was apparently central, on the morning of the 7th, between Lakes Huron and Ontario, and might be considered as a branch of No. III. It evidently owed its origin to the combination of the moist southwest winds over the Lower Lakes in the rear of No. III, with the cold northwest winds also following that area. It passed rapidly eastward over New England and to the Atlantic, and was a well-marked depression on the morning of the 8th, central near the Bay of Fundy, whence it moved slowly northeastward, but does not appear to have been accompanied by any high winds up to the time of being lost sight of on the 9th.

No. V.—The barometer fell slowly on the 5th and 6th in southwestern Texas, with cloudy weather and occasionally brisk north and east winds; on the morning of the 7th a slight local depression was probably central between Galveston and Corsicana, whence it moved slowly eastward, increasing its dimensions, and accompanied by heavy rain and occasional brisk winds, it passed over the Florida Peninsula, 11 p. m. of the 8th, and disappeared on the 9th east of Florida, while light rains prevailed, during a part of the day, on the south Atlantic coast.

Nos. VI and VII.—Depression No. VI, which is first located on the morning of the 8th in northern Dakota, may possibly have originated in that neighborhood, under the influence of easterly winds, then prevailing, while an area of high pressure was central on Lake Superior, but more probable is it that this depression was the southern end of an extended area, in British America, parallel to the base of the Rocky Mountains, to which we may attribute both the low pressure in Oregon on the 9th and the high barometer over British America and Canada on 8th. On the morning of the 9th, the lowest barometer was in eastern Dakota, and a northerly gale prevailed at Bismarck, but high southerly winds in Minnesota. The barometer fell very generally southward to Texas, and the main depression seems to have passed eastward, and disappeared in Wisconsin, while a second depression, No. VII., formed on the 10th in Kansas, as usual, under the influence of prevailing warm southeasterly winds ascending the plains east of the Rocky Mountains. The barometric depression attending the formation of this storm, extended south to Texas and west to California. Southeast to southwest winds, with rain or snow, prevailed in Arizona on the 11th. The barometer rose rapidly, with northerly winds and snow, in Nevada, Wyoming, Colorado and Nebraska. The storm-centre was well-marked at 11 p. m. of the 11th in Iowa, after which it rapidly developed into a trough extending northeastward and southwestward, and ceased to exist as a well-defined storm centre after the morning of the 12th.

Nos. VIII and IX.—The southwestern extremity of the belt of low pressure that followed No. VII was attended during the night of the 12th-13th, by southerly winds, cloud and rain from Texas to Illinois. On the morning of the 13th rain prevailed, with northerly winds, in the upper Mississippi valley, but with southerly winds in the Ohio valley, and during the day the two depressions, Nos. VIII and IX, moved respectively from Indiana and Illinois northeastward. No. VIII had broken up by midnight into several small depressions over the Lower Lakes. No. IX moved more nearly northward over Lake Michigan, accompanied by heavy rains and occasional brisk winds, and disappeared on the 14th in northern Canada, whence it probably moved eastward to the Gulf of St. Lawrence. The barometer rose but little over the Lakes on the 15th, but on the 16th a moderate depression, extending, however, over a large area, seems to have moved eastward into northern New England, and to have disappeared over the Gulf of St. Lawrence.

No. X.—A slight depression existed in Oregon on the 18th, while the barometer fell steadily in Manitoba and Dakota. At 11 p. m. the pressure had risen decidedly, with clear, cold weather in Oregon, and the depression, which had very possibly at the time been developing in British America on the eastern slope of the Rocky Mountains, and had at no time been central on the western side, had extended rapidly southward into Kansas, whence it stretched as a very elongated oval northward into Manitoba. The pressure was lowest at Bismarck, at 11 p. m., 18th, with a southeast gale, had risen slightly, with calm, at 7:35 a. m., 19th, after which a brisk northwest wind sprang up and the barometer rose rapidly. On the 19th, 4:35 p. m., the lowest isobar was an ellipse, whose axis nearly coincided with the western boundary of Iowa. The movement southwestward of this depression now ceased and its northeastward movement began, (similar turning points in the progress of the low barometers, Nos. III, VI and XII, are all located in the same

neighborhood.) No. X moved northeastward and eastward over the Upper Lakes into New York, where it disappeared on the morning of the 21st. The brisk and high winds that attended the first part of its course diminished decidedly in the latter part.

No. XI.—The barometer fell quite low in California and Oregon on the 21st, and after 7:35 a. m., 22d, rose rapidly. The pressure was high, but slowly falling, on the 21st, west of Montana, with indications that a depression was then forming in Wyoming or Montana. At midnight of the 22d the barometer had risen over the Lake region and had fallen from Texas to Nebraska. The depression may be considered to have been central in Kansas, on the morning of the 23d, whence it stretched eastward, as a trough of low barometer, over Tennessee, while high barometer and cool northerly winds continued over the Lake region, Northwest and Ohio valley. During the 24th the western end of the trough of low pressure closed up under the influence of the steady flow of northerly winds, which reached into Texas by midnight, and the lowest barometer was confined to the South Atlantic coast; although it was now beyond the limits of our charts, yet the brisk and high northeast winds at the New Jersey coast stations, the ocean-swell and the threatening weather, justify the conclusion that a severe storm passed up the Gulf stream on that day, which may have had an independent origin near the West Indies, but was at least joined on the morning of the 25th by our No. XI. The path of the combined storms, from 26th to the 28th, is represented on chart No. I as passing along the coast of Nova Scotia, and is estimated from the indications afforded by the isobars and winds reported from neighboring stations.

Nos. XII, XIII and XIV.—The depression, which is first definitely located at 11 p. m., 26th, in northern Minnesota, was preceded by a slight fall of the barometer in Oregon, followed by a rise on the 25th and 26th, attaining its maximum on the morning of 27th. Southerly winds, rarely attaining to brisk, and falling barometer prevailed on the 26th over the Northwest, the Upper Lakes and the Ohio valley. Brisk northwest winds prevailed on the 27th from the Upper Mississippi westward, but rapidly diminished and were rarely reported on the Upper Lakes, after the depression had moved eastward. In its passage over the St. Lawrence valley, this disturbance gave rise to smaller depressions in the Middle States and New England on the 29th, some of which were, however, not of sufficient importance to be presented upon Chart No. I. One of them, which was central at 11 p. m., 29th, in Pennsylvainia, may be considered at the eastern extremity of the belt of low pressure, extending from Indian Territory to the Middle States. The southwest end of this belt is represented by No. XIV as stationary on the 30th; it developed into a severe storm, whose subsequent history belongs to the mouth of May. The eastern extremity, constituting low barometer No. XIII, moved northeastward, and was, at 11 p. m. 30th, off the New England coast, with a rapidly falling central low barometer; its subsequent history also belongs to May.

*Areas of High Barometer.*—In general, these have not been so well-marked as in April, 1875, and in consequence, areas of extended frosts have been rare and reports of very severe frosts have not reached us. The general progress of the areas of high barometer has been, as usual, from British America southward over the lakes; several minor areas have, however, pushed northward from the Gulf, and these, together with the rises in the barometer that have occured east of the Alleghanies, and west of the Rocky Mountains, show that when an area of low pressure is forming anywhere in the region east of the Rocky Mountains, its influence is felt in a very short time on both the Pacific and Atlantic coasts, and on the shores of the Gulf of Mexico and Hudson's Bay, as shown by the inflow of air and the rising pressure.

No. I.—This area extended, on the morning of April 1st, from the Middle and South Atlantic coasts northwestward over the Lake region; the pressure was highest on Lake Superior, with light winds and calms north of Wisconsin and Minnesota. The central high pressure moved eastward, and was, on the morning of the 2nd, north of New York. The barometer had risen decidedly over New England and the Gulf of St. Lawrence, and the southward flow of air extended along the Atlantic coast into Georgia, while to the west of the Alleghanies, warmer, cloudy weather prevailed, and low barometer No. II originated. The pressure diminished rapidly during the 2nd at the northern stations, and to a less extent on the Atlantic coast. On the morning of the 3rd, the pressure was highest east of the Middle Atlantic States, preceding the passage of low barometer No. I.

No. II.—On the 3rd and 4th, while the pressure was low at northern stations, southerly winds and rising barometer prevailed at the southern stations, and, simultaneously, high barometer also prevailed on the coasts of Oregon and California. On the morning of the 5th, while low barometer No. III was central over Lake Superior, cold northerly winds and rising barometer extended southward along a portion of the eastern slope of the Rocky Mountains into the Gulf States. The highest pressure was, on the morning of the 6th, central in southern Missouri, and on the morning of the 7th central in Tennessee, after which it passed eastward to the Atlantic.

No. III.—At 11 p. m., 7th, an area of rising barometer and clear, cold weather was rapidly extending southward over the Upper Lake region. At 11 p. m., of the 8th, was apparently central in northern Michigan, while low barometer No. VI was central in Dakota, and low barometer No. IV was central in Nova Scotia, and low barometer No. V central in northern Florida. The central area of highest pressure moved

slowly southeastward, being at 11 p. m. of the 9th between Lakes Huron and Ontario, and but little east of that place at 11 p. m. of the 10th; meanwhile a considerable extension of the area of rising barometer and northerly winds had taken place over the Middle Atlantic coast, and, reaching into the South Atlantic States, formed a ridge of maximum pressure from the upper St Lawrence to Florida. The pressure remained stationary in the South Atlantic States, but fell in the Middle States and Canada, and the area of highest barometer remained off the South Atlantic coast until 11 p. m., of the 13th.

No. IV.—The northerly winds and rising barometer in the rear of low pressures Nos. VIII and IX covered Texas on the 14th at 7:35 a. m., and extended thence slowly eastward over the Southern States, remaining, however, highest on the Texas coast until the 16th, 7:35 a. m. Meanwhile a continuous southward flow of colder air was taking place, with rising barometer over Manitoba and the Northwest, reaching Indian Territory and Missouri at 7:35 a. m., of the 16th, and forming, at 7:35 a. m., of the 17th, a ridge of high pressure from Manitoba to the Western Gulf. The pressure now began to fall in Manitoba, and the area of highest barometer, at 7:35 a. m., of the 18th, extended from Louisiana to Illinois, whence it moved slowly eastward and was, at 7:35 a. m., of the 19th, central in the interior of North Carolina, and, at 7:35 a. m., of the 20th, off the South Carolina coast.

No. V.—In the rear of low barometer No. X northerly winds extended southward only as far as Kansas and Missouri, while southerly winds and rising barometer prevailed in the Gulf States, which movement may apparently be described as an extension westward of the high pressure No. IV or of the general area of high pressure prevailing under the tropic of Capricorn. The rising barometer in the Northwest extended eastward over the Ohio valley and Lake region, reaching the Middle Atlantic States on the morning of the 22d, after which this ill-defined area of high pressure can be no longer traced.

No. VI.—While low barometer No. XI was developing in Kansas, and the pressure was falling in the Southern States, the barometer began to rise, with northerly winds and clear weather, over the Lake region. At 7:35 a. m., of the 23d, the barometer was highest, with northeast winds, over Manitoba and Lake Superior, and continued to rise in that region, where it was also highest, but with calms, at 7:35 a. m., of the 24th. It had fallen slightly by 7:35 a. m., of the 25th, by which time the highest pressure had passed to Illinois and Missouri, whence it moved eastward, and, at 7:35 a. m., of the 26th, extended from eastern Tennessee to western Pennsylvania, and was, at 11 p. m., of the 26th, off the South Carolina coast, where the highest barometer remained until the morning of the 28th.

## TEMPERATURE OF THE AIR.

*In General.*—The isothermal lines upon Chart No. II show the general distribution of temperature for the month, from which it appears that, in comparison with the average of many years, the month has been slightly cooler in the St. Lawrence valley and Atlantic States, and decidedly cooler in the Lower Lake region. It has been slightly warmer in the Gulf States, Ohio and Missouri valleys, and decidedly warmer in the Upper Lake region. The average temperature at the summit of Mt. Washington has been 19°.5, the maximum being 43° and the minimum 0°.

*Maximum Temperatures.*—The maximum temperatures for the month have been—Denver, 82°; Augusta, Cape Henry, North Platte, Vicksburg, Indianola, Leavenworth and Memphis, 85°; Denison, St. Marks and Savannah, 86°; San Diego and Tybee Island, 87°; Jacksonville, 88°; Montgomery and Shreveport, 89°; Corsicana and Dodge City, 90°.

*Minimum Temperatures.*—The minimum temperatures for April have been as follows: Cheyenne, Denver and Pembina, 4°, Breckenridge, 5°, Colorado Springs and Duluth, 8°, Escanaba, 9°.

*Ranges of Temperature.*—The greatest ranges of temperature have been 57° at Duluth; 59° at Yankton; 60° at Bismarck; 65° at Santa Fe; 66° at Dodge City; 69° at Breckenridge and North Platte; 71° at Cheyenne and Colorado Springs; 73° at Pembina; 78° at Denver. The least ranges have been 37° at Charleston, Portland, Me., Tybee Island and Smithville; 36° at Long Branch, New Orleans and Newport; 35° at Thatcher's Island; 34° at Indianola and Mobile; 33° at Cape May and Wood's Hole; 31° at San Francisco; 30° at Eastport; 29° at Galveston.

*Frosts*, or temperatures low enough to form ice, have been reported at various stations, in the following States, on the respective dates: 2d, N. J.; 4th, Tenn.; 5th, N. C., W. Va.; 6th, Ohio, Tenn., W. Va.; 7th, Kan., Md., S. C., N. C., W. Va.; 8th, N. C., S. C., W. Va.; 9th, N. J., N. C., S. C., W. Va.; 10th, N. J., S. C., W. Va.; 11th, Va.; 12th, Cal., Ill.; 13th, Cal.; 14th, Kan.; 15th, Miss.; 17th, Ill., Iowa, Tenn., Mich., N. C., N. J.; 18th, Ill., Iowa, Kan., Ky., N. C., Md., N. J., N. Y., Pa., Tenn.; 19th, Ga., Md., N. J., N. C., Ohio, Pa., S. C., Tenn.; 20th, N. J.; 21st, Wis.; 22d, Iowa, Wis.; 24th, Wis.; 25th, Ill., Ohio, Mich., Tenn.; 26th, Md., Ohio, Pa., Tenn., Va., W. Va.; 27th, Mass., N. J., N. Y., Ohio; 28th, Minn., Neb.; 29th, Minn., Mich., Ohio, Tenn., W., Va.; 30th, Ill., Ind., Iowa, Mich., N. J., N. Y., Ohio. Most of these frosts were, to a slight extent only injurious to vegetation.